Electronic Publishing

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THE TERM *electronic publishing* can be interpreted in several different ways. In the most pedestrian interpretation, computers and related devices are used for economy and convenience in producing a conventional print-on-paper publication. In the most sophisticated interpretation, the full capabilities of the electronic media—including motion, sound, and interactive features—are exploited in the creation of completely new publication forms. Various other possibilities exist between these extremes.

An attempt has been made in Table 1 to show the most important stages involved in the evolution of electronic publishing from the early 1960s to the present (and, indeed, on into the future). This is a complex evolutionary process, having many diverse facets, and any attempt to reduce it to a single table must necessarily be an oversimplification. Nevertheless, the table provides a useful framework for the proposed discussion. It identifies a number of steps involved in the application of electronics to publishing (presented roughly in chronological order) and attempts to show their impact on the creators, distributors, and users of publications.

COMPUTER USED TO PRINT

The first step is the use of electronic devices to generate publications (through "computer typesetting" [photocomposition]). Since the products thus generated were "conventional" print on paper, this development had little immediate impact on the reader except that it may have helped to slow the escalating subscription costs for certain publications and perhaps to allow them to be produced more rapidly.

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In order to photocompose, one must build a machine-readable database. From the publisher's standpoint, this in itself is the major benefit of the operation. Data manipulation—including sorting, error checking, and indexing operations—are greatly facilitated when the data are in machine-readable form. This was particularly important to the publishers of the large indexing and abstracting services. More importantly, after the printed publication had been generated, the machine-readable database was still in existence and could then be used to generate other information products and services (the second step depicted in the table).

Once publishers began to deal with machine-readable data, it became possible for authors to submit material to them in machine-readable form. Although this was theoretically possible from the beginning of electronic publishing, it is only recently that rapidly decreasing costs and the wide availability of personal computers have made this a practical proposition (Armbruster & Yates 1982; Shotwell 1982). The author who chooses to work at some type of terminal may have the advantage of access to various machine aids, including programs for the editing of text, for checking of spelling, for building of indexes, and so on (Coke 1982). The same terminal may also allow access to various personal files and other sources of information needed in the creative task of composition.

Having a database in machine-readable form also makes possible "on demand publishing." That is, a publication can be generated and distributed as and when it is ordered by a consumer. Starr (1983) has referred to the publication of directories in this way and points out that a laser printer can generate pages ready for binding at a rate of about two per second. It has been suggested that future bookstores might keep only one display copy of each item and generate copies for sale when requested.

On demand publishing has other advantages for the consumer. Since the machine-readable database is easily updated, a purchaser can always buy the latest version of certain types of publication. Moreover, customized formatting of output might also be possible. Carried to its logical conclusion, perhaps, a publication would be "printed" onto some reusable medium, somewhat resembling a videotape or videodisc (Maurer et al. 1982; Shneour 1983) and it would perhaps incorporate movement and sound as well as text and static illustrations.

ELECTRONIC DISTRIBUTION

The second and third stages of the evolution depicted in Table 1 refer to the distribution of publications in electronic form. In the second stage, publications are distributed in electronic form as well as in the form of print on paper. In the third stage, however, completely new publications emerge only in the electronic medium. Because of cost and limited demand, many of these could not be produced economically in a

TABLE 1
EVOLUTIONARY STAGES IN ELECTRONIC PUBLISHING

Use of electronics	On creator	Significance/Impact		
		On publisher	On reader/user	
Print on paper	Author can work at terminal and submit material to publisher in machine-readable form	Financial economies By-product database	Possible cost containment Possible reduction in publication delays Publication on demand	
Distribute publications also distributed in paper form		New products and services	New tools New capabilities Access substitutes for ownership	
Distribute *new* publications	Editors/compilers conceive of new projects	New products and services	Access to data not otherwise available Access to completely current data Tailor-made journals	
Allow computer conferencing	Collaborative authorship facilitated	New products, including in-formal journals Author may become publisher	Access to "knowledge base" of new level of authority derived by consensus Interaction among users and authors, and users and users	
Produce new textual presentations	Author can plan presentation of textual information differently		Reader can modify and interact with text, author, or other readers	
Present information or inspira-tion in new ways, including movement and sound	Authors conceive of new ways of presenting information, with less reliance on text New art forms		"Reading" becomes more "parti-cipatory" and "experiential"	

paper form; others are not suitable for printing on paper because of the frequency with which the data presented must be updated.

In the 1960s, the electronic distribution of information had a very limited impact because it largely took the form of distribution via magnetic tapes for use on large mainframe computers. The impact increased dramatically in the 1970s as online networks fell into place and continues to increase as the networks expand, costs decline, and the volume of resources accessible online multiplies. In the 1980s, various forms of electronic publication are *accessible* online (via conventional computer networks or through television) while others may be *distributed* in magnetic tape, videotape, optical disc (including CD-ROM), or other form.

It is possible to do various things with a text in electronic form that one cannot achieve so effectively with print on paper. Most obviously, one can search it by computer and thus provide services for retrospective searching and selective dissemination of information. This allows one to conceive of completely new approaches to the packaging of information. For example, rather than subscribing to a single journal, a scholar could have his or her profile of interest matched against the articles accepted into a wide range of electronic journals. In effect, the "network" would create a journal tailor-made to fit the interests of the individual.

The ability to access sources online has a profound impact on the economics of information distribution. In the online environment, the consumer pays only for what is used. A publication need not be "owned" to be readily accessible. This is particularly important for libraries: many sources of information can be made available to users that could not be available if the library were required to purchase and store the source.

COMPUTER CONFERENCING

Collaborative authorship is possible in the print-on-paper environment but is rather difficult to accomplish especially if more than two authors are involved. Facilities for computer conferencing and electronic mail, readily available through many networks, make it much more feasible for publications to be produced through the cooperative effort of several authors. This allows the production of new types of publication of great authority, the result of a consensus reached by a group of experts. A prototype of such a "knowledge base" has been prepared by the National Library of Medicine (Bernstein et al. 1980; Siegel 1979).

Computer conferencing networks make possible other unconventional approaches to publishing. The author can become his own publisher, entering an item into the network and allowing readers to access it. In the same way, informal journals or newsletters can be created within the network.

Perhaps more importantly, readers and authors can communicate easily among themselves. Thus readers can share opinions about a particular publication or can enter into a dialogue with the author. All of these dialogues can be made available to be read by other users of the conferencing facilities. Carried to its logical conclusion, an article in an electronic journal can be linked to a series of evaluative comments or reviews contributed by various readers of the article (Roistacher 1978).

HYPERTEXT

In all of the developments discussed so far, electronic devices are used to produce conventional print on paper or to display on some type of terminal a publication that closely resembles print on paper. In fact, one could say that electronic publishing has tended to simulate the printed page in much the same way that many early printed books were handcrafted to resemble illuminated manuscripts. Putting the *Encyclopaedia Britannica* online does not create an electronic encyclopedia and displaying a Shakespearean sonnet at a terminal does not create "electronic poetry." In a true electronic publication, presumably, the author does not conceive and design his work as narrative text on a printed page; instead, he considers how the full capabilities of the electronic media can be used to present the message to be conveyed.

Although the printed book has been with us for only 500 years—a very short time in the complete history of human communication—it seems very difficult to break conceptually from its traditions, conventions, and limitations. For example, virtually all of the experimentation that has taken place with "electronic journals" has assumed that information will be presented as it has been presented in science journals for the past 300 years—as static text and static illustration. Indeed, these experiments have virtually concentrated on how best to display conventional text electronically, how to give the reader some idea of where he "is" in this text, and how to help him to move around in it effectively. The authors of one major study on the electronic journal have been quite explicit on its limitations: "No assumption is made in this description of the design of the *Computer Human Factors* journal that the product is anything but an initial mounting of conventional paper structures on to electronic media whether it is appropriate to do so or not" (Shackel and Pullinger 1984, p. 39). Other investigators, while focusing on textual display, have at least recognized that an electronic text need not be as static as text printed on paper:

> Electronic transmission could have an effect on writing and reading, not only by encouraging the writing of marketable material, but by favouring smaller units of information. The shorter the article, the better for identification and transmission; better still, the information in it can be broken up into small blocks, like articles in a concise encyclopaedia. The user would have then to piece together his own packages from the blocks: the original writer then becomes a brickmaker, and the user a builder, perhaps even an architect. (Line 1982, p. 145)

While the printed book does have many virtues, its static quality is its major limitation. Once produced it is difficult to update. Moreover, the user of the book cannot readily change it in any way—highlighting and annotation are possible, but rearrangement of the text is virtually precluded by the physical format.

An electronic publication, on the other hand, can be dynamic rather than static. One possibility is to incorporate some form of hypertext capability.

Hypertext (Nelson 1981; Conklin 1987; Smith 1988) is a text presentation system in which the user is free to direct its movement in a way that is logical to him instead of being restricted solely to the sequence that is logical to the author. It combines flexibility of access, ability to comment in context, and ease of locally modifying the text to make it highly specific to individual needs and specifications. More specifically, Nelson speaks of making rapid, arbitrary jumps, where material stored in one place may offer a link, much like a footnote, to material stored in another, in either the same or a different document. Such an arrangement is highly dynamic since the reader can pursue various pathways through the text and can make various comments or annotations as he proceeds. In addition, the text could be constantly updated through computer conferencing among a group of subject specialist authors. Thus this form of presentation is not prespecified, but transforms the organization of its contents into a more useful form for each individual reader (Weyer 1982).

Thursh and Mabry (1980) have developed an electronic textbook using the hypertext principle. An electronic textbook can look much different from one printed on paper. It need not be designed to be read in one particular sequence. It may allow many alternative reading pathways or be capable of reorganization into various sequences to meet the needs of different instructors, courses, or students. At any point, a student may enter an annotation, comment, or question to an instructor. Instructor responses can also be incorporated and, for any portion of the text, a student could get access to the questions and comments of other students and/or the responses of several instructors. Furthermore, the text itself can be constantly updated by means of computer conferencing.

Likewise, one can visualize an electronic encyclopedia that is reorganizable under the control of the reader. For example, information on coffee could be dispersed throughout various volumes and pages of a conventional encyclopedia. Not only would the electronic encyclopedia allow the reader to bring all relevant passages together, but it would also allow him to preserve all these passages on some local storage medium. Electronic publication, then, can affect the presentation of narrative, both by promoting conciseness and by creating a more dynamic presentation whose sequence can be changed and expanded in places by the reader.

Weyer (1982) has discussed the dynamic book in some detail. He sees the major difference between the electronic book and the conventional book as being the ease with which the former can be searched for specific passages or factual information.

HYPERMEDIA PUBLICATIONS

While text can be made dynamic and reorganizable, narrative text might be much less important in electronic publications in which animation, electronic models, moving pictures, and sound can be employed by the author. Several electronic forms, including optical disc and interactive television, offer the possibility of incorporating sound to supplement or reinforce the use of text and graphics. In fact, Greenagle (1981) has pointed out that, when the television set becomes the reader's terminal, sound is actually expected:

> The research also revealed that people reading an article on their TV screen expected that a noise of some sort should also come from that set; they have been conditioned to expect sound as well as video, and were somewhat disconcerted by the silence—"sensory deprivation" is what psychologists would term it. (p. 179)

The advantages of being able to use sound within a publication are obvious: articles on music can include brief passages from the works of various composers, some biographies may incorporate the voice of the subject, and other articles may be illustrated by bird song or animal sounds.

The graphics capabilities of electronics are even more exciting. However good the quality of an illustration in a printed book, this illustration is entirely static. This makes little difference when a static object is depicted, as in the reproduction of a famous painting, but it is a definite restriction when an author is trying to describe how something works. Electronic publications can include not only static illustrations but also motion picture segments as well as animation or electronic analog models.

Electronic display permits the use of very effective analog models. It is possible to model a scientific experiment in, say, chemistry or physics, as well as to produce working models of various types of equipment. It is not difficult to realize that electronic publications need not be restricted to the static properties of the printed page. The true capabilities of electronics in publishing are only reached when completely new and dynamic publications emerge. A true electronic encyclopedia, then, would incorporate dynamic analog models of equipment and experiments. In an encyclopedia for children, for example, a rather lengthy narrative description of what makes an airplane fly, accompanied by a few static diagrams, could be replaced by an electronic model of the plane. This type of publication would be truly interactive and the "reader" would become, in effect, an active participant in the publication. In fact, such a publication might closely resemble what we now think of as an electronic game.

The same capabilities could be extended to other types of publication. Consider the capabilities of future journals in scientific/technical fields. Rather than describing what happens when stresses of a particular type are applied to some structure, a journal in applied mechanics could demonstrate these effects. Moreover, since computer programs can be incorporated into a contribution to an electronic journal, the reader could actually perform new data manipulations, varying the loads or stresses, for example, and observe the effects. Future publications can be truly interactive. The possibilities are limited only by the imagination.

Yankelovich et al. (1985) have coined the term *hypermedia* to refer to publications having:

> the functionality of hypertext but with additional components such as two- and three-dimensional structured graphics, paint graphics, spreadsheets, video, sound, and animation. With hypermedia, an author can create links to complex diagrams, texts, photographs, video disks, audio recordings, and the like. (p. 19)

The ability to combine textual information, visual images (static and moving), and sound into an interactive system has stimulated work on what Negroponte (1979) has referred to as "books without pages." In Negroponte's system, developed at MIT, the reader sits in a chair whose arms are fitted with a joystick and touch-sensitive pad. These facilities can generate whole-wall displays (including a zoom capability) of text or graphic information as well as sound. Moreover, the reader can move the material around and, as it were, browse in an "information space." Different sources (i.e., databases) can be brought together on separate but adjacent screens, and the reader is given some capability to annotate and store in an electronic notebook. One derivation of Negroponte's work is the Spatial Data Management System (SDMS), based on optical disc technology, which is said to store static and moving pictorial information in a "spatial location," allowing the user to search, browse, and retrieve in an "information space." The basic system comprises two monitors, a microcomputer, and an industrial disc player. One capability is "vicarious travel": a user can take a simulated trip through a selected geographic area using a joystick to control the speed and direction of the travel. This feature is now being used by the U.S. Army to teach spatial orientation and navigation skills. Such interactive optical disc technology is considered to have great potential in a variety of instructional applications ("Instructional Applications" 1982).

While imaginative works have been little affected by electronics up to now, there is no reason to suppose they will remain unaffected. The electronic novel, for example, can be quite different from the conventional novel. As with other types of publications, it can incorporate sound and movement; it can also allow the reader to choose which direction he wants the plot to take.

Krueger (1983) has given a rather detailed discussion on some of the possibilities for creative writing in electronic form. One is kinetic poetry

(expression through the animation of words). In this form, poetry becomes a kind of dance:

> The words and letters could constantly be in a state of flux, moving around the screen, juxtaposing with other words, transforming themselves into new words, picking up new letters and disbanding—in ways limited only by the imagination of the programmer poet. A sequence of such interactions could constitute a poem. (p. 198)

Krueger suggests the possibility that, in interactive poetry, the words could even travel around the reader ("participant") through, for example, holographic projection:

> Words displayed on a lighted graphic floor could follow the participant or be chased by the participant....Allowing a word to interact physically with a participant is a symbolic statement, for the word is then no longer a vehicle for communicating meaning, but an entity behaving on its own. Given the impact of television and film, and the fact that computers are slowly acquiring the ability to speak and understand speech, the written word may one day be obviated. Thus, it seems appropriate to give it life, allow it to leave the page, interact with the person who wrote it, and leave the scene. (p. 199)

CONCLUSIONS

Yankelovich et al. (1985) point out that publications in electronic form can "offer substantial advantages over paper books in providing aids for connectivity, audiovisualization, dynamics, customizability, interactivity, and rapid information retrieval..." (p. 18). Electronic publications are not ipso facto superior to those printed on paper. What is certain is that a true electronic publication is very much more than print on paper presented electronically. Electronic publishing will come into its own when authors learn to free themselves from earlier conventions and limitations and exploit the full capabilities of the electronic medium.* The hypertext and even hypermedia capabilities opening up for the user of personal computers, through such devices as Apple Computer's Hypercard (Hallerman 1987), can be expected to accelerate this transition.

The ability to access various electronic information sources online has already had a significant impact on many libraries and these libraries are now adapting to the emergence of increasing numbers of databases on CD-ROM (Miller 1987; Silver 1988; Reitdyk 1988). Nevertheless, the impact on libraries so far has been limited by the fact that the electronic publications most widely available have been bibliographic databases that support only one library activity and are little more than print on paper displayed electronically.

It seems reasonable to assume that completely new types of electronic publications will emerge in the future, perhaps on media yet to be invented. Such publications may span the entire range of resources now

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*This article covers the exploitation of electronic capabilities by authors of various types but not the use of computers to *create* poetry, stories, and other forms of expression. This type of work has recently been reviewed by Hjerppe (1986).

handled by libraries—from textbooks to instructional manuals to novels to poetry to children's picture "books"—and they may be available in a wide variety of formats. This will create a formidable challenge for the profession.

REFERENCES

Armbruster, D., and Yates, D. 1982. "Saving Keystrokes." *Scholarly Publishing* 14 (1), pp. 35-37.

Bernstein, Lionel M., et al. 1980. "The Hepatitis Knowledge Base." *Annals of Internal Medicine* (Part 2) 93 (1), pp. 169-81.

Coke, E.U. 1982. "Computer Aids for Writing Text." In *The Technology of Text: Principles for Structuring, Designing, and Displaying Text*, edited by D.H. Jonassen, pp. 383-99. Englewood Cliffs, NJ: Educational Technology Publications, Inc.

Conklin, Jeff. 1987. "Hypertext: An Introduction and Survey." *Computer* 20 (9), pp. 17-41.

Greenagel, F.L. 1981. "Aretê—A 3000-Year-Old Word for the Latest in Electronic Publishing." *Electronic Publishing Review* 1 (3), pp. 177-82.

Hjerppe, Roland. 1986. "Electronic Publishing: Writing Machines and Machine Writings." *Annual Review of Information Science and Technology* 21, pp. 123-66.

"Instructional Applications of Spatial Data Management." 1982. *Videodisc/Videotex* 2 (3), pp. 181-87.

Krueger, Myron W. 1983. *Artificial Reality*. Reading, MA: Addison-Wesley.

Line, Maurice B. 1982. "The Production and Dissemination of Information: Some General Observations." In *Multi-Media Communications*, edited by M. Katzen, pp. 138-46. Westport, CT: Greenwood Press.

Maurer, H.A., et al. 1982. "Printing Without Paper." *Electronic Publishing Review* 2 (2), pp. 151-61.

Miller, D.C. 1987. *Special Report: Publishers, Libraries & CD-ROM*. Benecia, CA: DCM Associates.

Negroponte, Nicholas. 1979. "Books Without Pages." *Conference Record*, pp. 56.1.1 to 56.1.8. IEEE International Conference on Communications, Boston, June 10-14.

Nelson, Theodore H. 1981. *Literary Machines*. Swarthmore, PA: Author.

Rietdyk, R.J. 1988. "Creation and Distribution of CD-ROM Databases for the Library Reference Desk." *Journal of the American Society for Information Science* 39 (1), pp. 58-62.

Roistacher, Richard C. 1978. "The Virtual Journal." *Computer Networks* 2 (1), pp. 18-24.

Senders, John W. 1980. "The Electronic Journal." In *EURIM 4*, edited by L.J. Anthony, pp. 14-16. London: Aslib.

Shackel, B., and Pullinger, D.J. 1984. *BLEND-1: Background and Developments*. London: The British Library.

Shneour, Elie A. 1983. "A Look Into the Book of the Future." *Publisher's Weekly* 223 (3), p. 48.

Shotwell, Robyn. 1982. "How Publishers Can Use Personal Computers." *Publisher's Weekly* 221 (6), pp. 284-85.

Siegel, Elliot R. 1979. "Validating and Updating the NLM's Hepatitis Data Base: The Role of Computer Conferencing." *Proceedings of the American Society for Information Science* 16, pp. 124-30.

Silver, Howard. 1988. "Managing a CDROM Installation ... a Case Study at Hahnemann University." *Online* 12 (2), pp. 61-66.

Smith, K.E. 1988. "Hypertext—Linking to the Future." *Online* 12 (2), pp. 32-40.

Starr, Paul. 1983. "The Electronic Reader." *Daedalus* 112 (1), pp. 143-56.

Thursh, Donald, and Mabry, Frank. 1980. "An Interactive Hyper-text of Pathology." In *Proceedings of the Fourth Annual Symposium on Computer Applications in Medical Care*, pp. 1820-25. New York: Institute of Electrical and Electronic Engineering.

Weyer, S.A. 1982. "The Design of a Dynamic Book for Information Search." *International Journal of Man-Machine Studies* 17 (July), pp. 87-107.

Yankelovich, Nicole, et al. 1985. "Reading and Writing the Electronic Book." *Computer* 18 (10), pp. 15-30.